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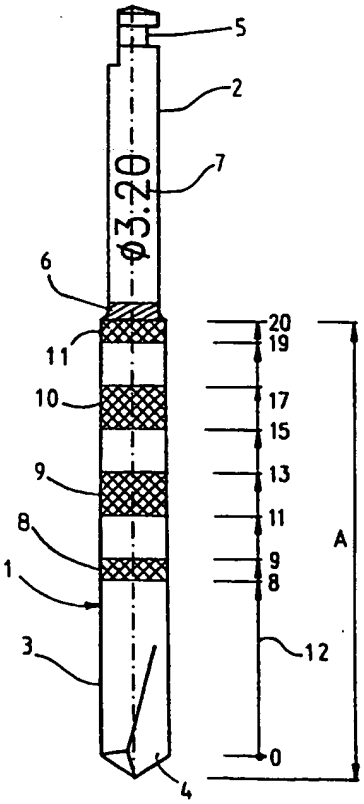
(54) Title: METHOD OF TREATING SURGICAL DRILL, SURGICAL DRILL AND USE OF SURGICAL DRILL

(57) Abstract

The invention relates to a surgical drill made of metal, for instance made of surgical grade stainless steel or carbon steel, intended for use when implanting cylindrical implants into bone tissue, preferably dental implants made of titanium. The body (3) of the drill (1) is coated by a thin layer of titanium nitride (TiN). The layer of titanium nitride is brightly coloured and circumferential bands (8, 9, 10, 11) having a darker colour have been etched around the envelope surface of the body (3) of the drill, said bands (8, 9, 10, 11) being located at predetermined distances from each other and having predetermined widths.



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METHOD OF TREATING SURGICAL DRILL, SURGICAL DRILL AND USE OF SURGICAL DRILL

Technical field of the invention

The invention relates to surgical drills made of metal, for instance made of surgical grade stainless steel, which are intended for use when implanting cylindrical implants into bone tissue, preferably dental implants made of titanium. The invention also relates to a method for treating such drills and to the use of such drills.

Background of the invention

When implants are fitted into bone tissue, different kinds of metallic surgical tools are used to prepare the site in the tissue where the implant is to be located. These tools normally are made of carbon steel (normally in disposable tools) or surgical grade stainless steel (normally in non-disposable tools).

In some cases it may however be advantageous if at least the surface of the tools are covered with a material which is more biocompatible than the material in the tool even if the tool is not to remain in the bone tissue for a long period of time. This material of course should be equally hard or harder than the material in the tool. This is particularly advantageous in drills. Drills will be in a close contact with the tissue during a relatively long period of time since their sides are in rotary contact with the sides of the borehole during the entire time the front part of the drill is cutting through the bone

tissue. If the drill is not of an inert material as regards the chemical environment prevalent in bone tissue and blood, some slight contaminations may affect the sides of the bore hole. These contaminants can affect the so-called osseointegration process which is important in connection with bone implants and which seems to be sensitive in respect of contaminants.

Another prerequisite for a good osseointegration is a good, stable fit between bone tissue and implants, the osseointegration being dependent on a close contact between bone tissue and implant surface. When a bore-hole for an implant is drilled, it therefore is important that the length of the bore-hole corresponds as closely as possible to the length of the implant chosen.

It is also very important that the bore-holes are drilled to an exact, pre-determined depth in the parts of the jaw where the nerve is located in order to avoid damage to the nerve.

Brief description of the inventive concept

The above problems are solved in that a drill of the kind described introductorily is coated by a thin, brightly coloured layer of titanium nitride (TiN). Titanium nitride has a higher level of biocompatibility than the materials normally used in surgical drills.

In a preferred embodiment circumferential band(s) having a darker colour have been etched in the brightly coloured layer of titanium nitride around the envelope surface of the drill. Said bands are located at pre-determined distances from each other and have pre-determined widths.

Further advantageous embodiments and a use of a drill according to the invention are set forth in the dependent claims. A method of obtaining a drill according to the invention is set forth in the independent claim 6.

Brief description of the appended drawing

The only drawing shows a preferred embodiment of a drill according to the invention in a longitudinal side view.

Detailed description of a preferred embodiment of the invention

A drill 1 designed in accordance with the invention is shown in the drawing. The drill is provided with a shank designed with a tang 5 designed in accordance with ISO 1797. The diameter of the drill is etched in the shank, at 7. The drill in this particular case is manufactured of stainless steel W.Nr 1.4034, AISI 420.

The drill 1 further is provided with a fluted body 3 having two helical flutes 4, only one being indicated. The neck between the body and the shank is provided with a coloured band 6 identifying the size of the drill in that each size of drill has a band of a different colour.

The entire length A of the body is covered with a thin layer of titanium nitride having a bright yellow colour.

As indicated by means of the chain of measurements 12, a dark band 8 having a width of 1 mm is located at a distance of 8 mm from the tip of the drill 1. Each following dark band 9, 10, 11 is separated from the

adjacent band by means of a space having a width of exactly 2 mm. Since the titanium nitride has a bright yellow colour and the darker bands are almost black, a very distinct level indication is given at each boundary line between darker bands and lighter areas.

The drill according to the invention can be fabricated in the following steps:
a) coating the drill with a thin layer of titanium nitride (TiN) by means of chemical vapour deposition until the drill obtains a bright permanent colour,
b) etching circumferential bands with pre-determined widths being located at pre-determined distances from each other around the outer surface of the drill by means of a laser beam, the bands thus being dark and sharply defined.

The use of a laser beam has the advantage that the boundary lines will be very sharp and well defined and that the contrast between darker and lighter areas will be high.

The etched areas will remain essentially smooth in spite of the treatment, which ensures that there will be no rough areas on the drill upon which contaminants easily will adhere.

When the drill is to be used, for instance in order to implant a screw-shaped fixture for a dental implant, the type of fixture is first chosen in accordance to the prevailing conditions in the jaw, i. e. for instance the shape of the jaw-bone. A drill having a diameter adapted to the diameter of the implant is then chosen and a hole is bored into the jaw-bone. As mentioned above, the drill is provided with dark, circumferential bands corresponding to the lengths of a series of standard sizes of implants having a diameter

corresponding to the diameter of the drill. The bore-hole is drilled to a depth determined by that boundary between darker band and lighter titanium nitride surface which corresponds to the implant chosen. The fixture is then screwed into the jaw bone. Since the depth of the hole exactly corresponds to the length of the fixture (or of the threaded part thereof), the fixture will fit closely in the hole.

Bone implants may also be relatively smooth instead of being provided with threads. This kind of implants sometimes are carefully tapped into place in a borehole in the bone by means of a small hammer. The bore-hole may have a diameter which is slightly narrower than the diameter of the implant. However carefully this is done, there always is a risk that the fixture may be pushed to far down into the hole if the length of the hole does not exactly correspond to the fixture. The drill according to the invention thus may be particularly useful in this case, since it may be difficult to extract an implant which has been pushed to far down into a hole.

These problems might also arise if the bore-hole is to shallow for the implant. In both cases the act of extraction per se might cause a trauma to the walls of the bore-hole which might have a deleterious influence on the osseointegration process.

If the surface of the bone into which the fixture is to be inserted is obliquely oriented relative to the longitudinal direction of the hole, the above-mentioned boundarys on the drill will also serve as indexes on a ruler for measuring the difference in level between the edges of the bore-hole and will consequently be very useful when determining how deep the hole has to be in order to house the implant correctly in relation to the

oblique surface of the bone.

It should be emphasized that the invention is not limited to the embodiment described above and can be varied in many ways within the scope of the appended claims.

In particular, the invention should not be considered to be limited to the field of dental implants. The invention thus also is applicable to the entire field of implants in bone tissue.

Furthermore, the bore-hole for instance could be bored in two stages a first stage with a narrow pilot drill and a second stage with a full-size drill. It might also be conceivable to provide only one band on the drill body.

CLAIMS

1. Surgical drill made of metal, for instance made of surgical grade stainless steel or carbon steel, intended for use when implanting cylindrical implants into bone tissue, preferably dental implants made of titanium, c h a r a c t e r i z e d in that the body (3) of said drill (1) is coated by a thin layer of titanium nitride (TiN).

2. Surgical drill according to claim 1 having a brightly coloured layer of titanium nitride, c h a r a c t e r i z e d in that circumferential band(s) (8, 9, 10, 11) having a darker colour have been etched around the envelope surface of the body (3) of the drill, said bands (8, 9, 10, 11) being located at pre-determined distances from each other and having pre-determined widths.

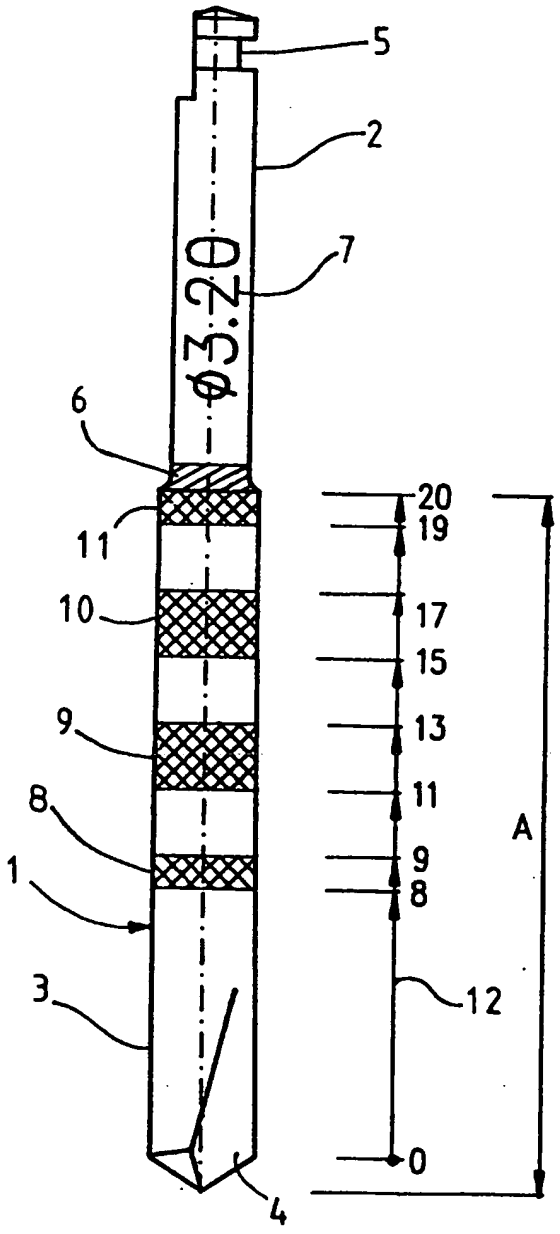
3. Surgical drill according to claim 2, c h a r a c t e r i z e d in that each boundary line between darker bands and more brightly coloured areas on the drill corresponds to a specific standard size of implant.

4. Surgical drill according to anyone of claims 2 or 3, c h a r a c t e r i z e d in that each band (9, 10) has a width of 2 mm, apart from the band (8) located next to the tip of the drill and the band located next to the neck of the drill which have a width of 1 mm, the distance between the edges of each pair of adjacent bands being 2 mm.

5. Use of drill according to any one of claims 1 - 4, comprising the steps of
a) choosing a standard size implant according to the

prevailing conditions of the bone tissue into which the implant is to be implanted,
b) drilling a hole for the implant by means of a drill, said drill having a diameter corresponding to the diameter of the chosen implant, to a depth corresponding to the length of the implant, said depth being determined by means of that distinct boundary between darker and lighter areas corresponding to the implant chosen,
c) inserting the implant.

6. Method for treating surgical bone drills made of metal, for instance surgical grade stainless steel or carbon steel, intended for use when implanting implants into bone tissue, preferably dental implants made of titanium, comprising the steps of
a) coating the drill with a thin layer of titanium nitride (TiN) by means of chemical vapour deposition until the drill obtains a bright permanent colour,
b) etching circumferential bands with pre-determined widths and being located at pre-determined distances from each other around the outer surface of the drill by means of a laser beam, the bands thus being dark and sharply defined.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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 93/00452

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: A61B 17/16, A61C 3/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: A61B, A61C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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P,X	US, A, 5125838 (M. SEIGNEURIN), 30 June 1992 (30.06.92), column 1, paragraph 1	1
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X	DE, C1, 3339004 (SCHMIDT, K.-H.), 27 June 1985 (27.06.85), column 2, line 24 - line 26	1
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Y	DE, A1, 3622676 (SCHOLZ, W.), 12 March 1987 (12.03.87), figures 1-3, claim 1	2-4
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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18 August 1993	19 -08- 1993
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INTERNATIONAL SEARCH REPORT

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

02/07/93

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